

Voluntown, Connecticut, 1st.—A faint auroral light was visible during the evening.

Eric, Pennsylvania.—An auroral light of moderate brilliancy was visible from 12.20 to 2 a. m. of the 2d.

Cleveland, Ohio, 1st.—An auroral light was visible until midnight, the light extending from northwest to east.

Grand Haven, Michigan.—A faint auroral display was noted from 9 p. m. of the 1st to 2 a. m. of the 2d.

Escanaba, Michigan, 1st.—A diffuse auroral light was observed from 7.25 to 9.58 p. m.

Fort Buford, Dakota, 1st.—An auroral arch of pale white formed at 8 p. m., having an altitude of 40°, and extending from northwest to northeast. The display disappeared at 11.18 p. m.

The following stations also report the display of the 1st, the description given being similar to those published above: Bangor and Cornish, Maine; Fall River, Massachusetts; Escanaba, Michigan; Riley, Illinois; Cresco, Humboldt, and Monticello, Iowa; Manitowoc, Wisconsin; Moorhead and Saint Vincent, Minnesota; Fort Totten and Webster, Dakota; Madison and Sussex, Wisconsin.

Other displays occurred as follows:

On the summit of Mount Washington a faint aurora was observed during the early morning of the 1st.

Moorhead, Minnesota, 2d.—An auroral light, extending from the magnetic meridian to points 15° east and west, was observed at 9 p. m. It consisted of a straw-colored arch from which occasional beams extended upward. The display ended at 11 p. m. An auroral display was also observed on that date at Humboldt, Iowa.

Manitowoc, Wisconsin, 5th.—An aurora was observed at 5.30 p. m., appearing as a bright red spot in the northeastern sky, at an altitude of 15°.

Saint Vincent, Minnesota, 10th.—From 6 p. m. until daylight a faint auroral arch was observed in the north.

Clear Creek, Nebraska, 19th.—Bright auroral streamers were observed at 7.30 p. m.

Fort Totten, Dakota, 24th.—An aurora was visible in the northern sky from 8 to 11.30 p. m. The light was of a pale straw color, the upper limit being well-defined. A complete arch was formed, beneath which appeared a dark segment.

Escanaba, Michigan, 27th.—A faint aurora consisting of two straight bands of straw-colored light, with a dark base, was observed from 9.45 to 11.20 p. m.

Washington City, District of Columbia, 28th.—At 9 p. m. an aurora was observed, consisting of a narrow band of pale yellow light extending across the northwestern sky, and forming an imperfect arch, beneath which was the usual dark base.

Saint Vincent, Minnesota, 28th.—An auroral arch was observed from 5.30 a. m. until daylight.

#### THUNDER-STORMS.

Thunder-storms were reported from the various states and territories as follows:

Alabama.—Auburn, 24th.

Arizona.—At numerous stations on the 4th, and at Prescott on the 3d.

Arkansas.—Mount Ida, 5th, 6th, 13th; Fort Smith, 5th, 23d; Little Rock, 23d.

California.—Cape Mendocino, 23d.

Connecticut.—Of general occurrence on the 27th.

Florida.—Jacksonville, 3d; Newport, 14th, 25th, 27th; Pensacola, 24th, 26th; Limona, 27th; Archer, 27th; Cedar Keys, 31st.

Georgia.—Andersonville, 26th; Savannah, 27th.

Illinois.—Cairo, 23d; Springfield, 23d; Anna, 23d, 31st.

Indiana.—Rising Sun, 9th, 21st, 26th.

Iowa.—Humboldt, 6th.

Kansas.—Allison, 5th; Fort Scott, 5th; Independence, 5th; Wellington, 5th, 22d.

Kentucky.—Louisville, 31st.

Louisiana.—New Orleans, 7th; Grand Coteau, 7th, 30th; Liberty Hill, 6th, 24th, 29th, 30th.

Maine.—Gardiner, 7th; Portland, 7th.

Massachusetts.—Of general occurrence throughout the state on the 27th, and at Charlestown on the 20th; Cambridge, 28th.

Mississippi.—Vicksburg, 7th, 29th, 30th, 31st.

Nebraska.—De Soto, 6th; Genoa, 6th.

New Jersey.—Cape May, 2d; Moorestown, 29th; Sandy Hook, 27th; Vineland, 27th.

New York.—Flushing, 27th; New York City, 27th.

North Carolina.—Kitty Hawk, 1st, 2d, 5th, 26th; Weldon, 2d, 27th; Ocreeta, 24th; Smithville, 25th, 27th; New River Inlet, 26th; Fort Macon, 27th.

Pennsylvania.—Fallsington, 27th.

Rhode Island.—Block Island, 27th; Narragansett Pier, 27th; Point Judith, 27th.

South Carolina.—Charleston, 27th.

Tennessee.—Memphis, 7th, 23d, 24th; Ashwood, 23d; Nashville, 23d, 24th; Milan, 30th.

Texas.—Cleburne, 5th; Fort Concho, 5th, 6th; Barnesville, 5th, 26th, 30th; Galveston, 6th, 24th, 26th, 29th; Indianola, 6th, 26th, 29th.

Vermont.—Dorset, 9th, 27th.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

New England.—11th, 23d, 24th, 26th.

Middle Atlantic states.—3d, 13th, 14th, 23d, 29th, 30th.

South Atlantic states.—4th, 7th, 10th, 11th, 18th.

Eastern Gulf states.—4th, 8th to 11th, 13th.

Ohio valley.—6th, 12th, 29th.

Lower lakes.—1st, 7th, 12th, 13th, 17th, 19th, 20th, 26th, 29th.

Upper lakes.—3d, 13th, 15th, 16th, 17th, 19th, 20th, 26th.

Extreme northwest.—10th, 17th, 18th, 24th, 25th, 31st.

Upper Mississippi valley.—3d, 9th, 10th, 12th, 13th, 16th to 20th, 26th, 29th.

Missouri valley.—11th, 19th, 20th, 26th, 31st.

Solar halos were also observed at the following stations not situated in the districts named above:

Arkansas.—Lead Hill, 2d, 5th, 10th, 11th, 12th; Little Rock, 11th.

California.—San Francisco, 1st, 8th, 10th, 19th, 23d, 31st.

Florida.—Archer, 5th, 8th; Jacksonville, 5th.

Kansas.—Salina, 10th.

Oregon.—Roseburg, 8th.

Tennessee.—Chattanooga, 6th; Milan, 28th.

Washington Territory.—Bainbridge island, 10th.

Wyoming.—Fort Bridger, 2d.

##### LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

New England.—7th, 9th to 13th, 16th, 19th.

Middle Atlantic states.—4th, 6th, 7th, 8th, 12th to 15th, 17th.

South Atlantic states.—4th, 6th to 11th, 13th, 17th.

Florida peninsula.—7th to 10th, 13th, 18th.

Eastern Gulf states.—5th to 13th.

Western Gulf states.—6th to 16th.

Tennessee.—6th to 13th, 17th.

Ohio valley.—6th, 10th, 12th.

Lower lakes.—6th, 10th, 13th, 16th, 17th, 20th.

Upper lakes.—3d, 4th, 6th, 8th to 17th, 19th, 20th.

Extreme northwest.—5th, 8th, 10th.

Upper Mississippi valley.—5th, 8th, 10th, 12th, 15th, 17th.

Missouri valley.—4th, 9th to 12th, 15th, 17th to 20th.

Middle slope.—10th to 13th, 15th.

Southern plateau.—5th, 15th, 18th.

Northern plateau.—7th to 10th.

North Pacific coast.—8th to 12th.

Middle Pacific coast.—4th, 8th, 10th, 14th, 19th.

Lunar halos were also reported from the following stations not situated in the districts named above:

*California*.—Poway, Los Angeles and San Diego, 8th.

*Nebraska*.—North Platte, 12th.

*Nevada*.—Carson City, 1st, 8th.

*Texas*.—Fort Stockton, 21st.

*Utah*.—Salt Lake City, 7th, 16th.

#### MIRAGE.

Toledo, Ohio.—On the morning of the 6th the river presented a beautiful appearance from the effects of a distinct mirage. The Wheeling and Lake Erie railroad bridge loomed up through the mist in large proportions; and while it is two miles distant it did not appear to be more than one-half mile. The hulls of two vessels lying behind the Ohio Central wharf, on the east side of the river, were seen from this side of the river as though no object intervened.

Webster, Day county, Dakota.—At sunrise on the morning of the 11th a beautiful mirage was observed. The distant hills and other objects, ordinarily invisible, were apparently lifted into the range of vision, and the sun appeared in five pieces. The phenomenon lasted two hours.

Huron, Dakota.—A remarkably fine mirage was observed here between 8 and 9.30 a. m. of the 25th. The Wessington hills, thirty miles southwest of here, appeared to be only about three or four miles distant, presenting a palisade-like front several feet in height. The town of Wessington Springs, on the eastern slope of the hills, was clearly outlined. Houses and barns many miles away, and not ordinarily visible with the aid of a glass, were plainly seen, a number appearing in inverted positions.

#### MISCELLANEOUS PHENOMENA.

In the REVIEW for November, 1883, under the heading "miscellaneous phenomena," was published a summary of the reports received from the regular and voluntary observers of the Signal Service, relating to the unusual phenomenon, at sunrise and sunset, which has been so extensively observed in this and other countries. These remarkable sunsets were reported by observers during the preceding months, but owing to the limited number of observers reporting them their reports were not considered of sufficient importance to publish. In this REVIEW will be found the reports received during the previous months. They are as follows:

*Alabama*.—Montgomery, October 14th: the western sky presented a very peculiar appearance at sunset.

*Arizona*.—Fort Grant, October 23d: the sunset of this date was peculiar and beautiful; the western sky was filled with well-defined cirro-stratus clouds; at sunset these clouds were brilliantly illuminated, presenting a variety of color rarely seen.

*Yuma*, October 19th: for one and one-half hours after sunset the western sky was of a rich, blood-red color, which gradually faded away. The same appearances were noted on October 20th and 21st.

*California*.—Cape Mendocino, August 23d: a red sunset, preceded by unusual peculiarities of cloudiness, was observed here on this date.

*San Diego*, October 30th: a brilliant reflection in the western sky was visible for some time after sunset.

*Florida*.—Pensacola, October 8th: at sunset the sky was of a brilliant, luminous red, resembling the reflection from a vast fire, lasting for a considerable time after sunset. On October 9th, preceding sunrise, the sky was of a bright red color, reaching an altitude of about 30°.

*Georgia*.—Atlanta, October 30th: at sunset the whole heavens were of a dull, reddish hue. A peculiar, yellowish sunset was observed on October 31st.

*Indiana*.—Logansport: a yellow sunset, with a peculiar band of light of the same color, changing to dark red, was observed on August 13th.

*Kansas*.—Wellington, Sumner county, October 28th: a bright red sunset was observed.

*Massachusetts*.—Somerset, Bristol county: during September and October numerous beautiful autumnal sunsets were observed.

*North Carolina*.—Charlotte, October 30th: a brilliant sunset was observed, followed by an intensely red light, resembling the reflection from a vast fire.

*South Carolina*.—Stateburg, Sumter county: brilliant, red sunsets were observed on October 30th and 31st.

*Tennessee*.—Memphis: brilliant, rosy sunsets were observed on October 29th, 30th, and 31st; they were at first thought to be the reflection from a large fire.

*Nashville*, August 22d: a beautiful sunset was noted. On September 5th and 6th the sunset shadows were very bright. On October 7th they were again very bright and distinct. The sunset of October 29th was unusually brilliant, being of a bright red color, which remained visible until 6.40 p. m. A similar sunset was also observed on the 30th.

*Virginia*.—Lynchburg: shortly after sunset on October 30th and 31st the western sky presented a hazy and rose-tinted appearance, extending upward 45°, and resembling the zodiacal light.

The following reports relative to this phenomenon were received from the various states and territories for the month of December:

*Alabama*.—Auburn, Lee county, 1st: a remarkable sunset.

*Arizona*.—Fort Bowie: red sunsets on the 11th, 17th, and 27th.

*Arkansas*.—Fort Smith: at sunset of the 6th a peculiar, greenish tinge was noticeable in the western sky, gradually increasing in extent and changing to a deep red color. The illumination continued for one hour after sunset. Similar appearances were observed on the 7th, 8th, 14th, and 26th.

*Fayetteville*, Washington county, 31st: a remarkable redness of the sky, continuing for some time after sunset, was observed on almost every evening during the month.

*California*.—Princeton, Colusa county, 18th: the red sunsets prevailed during a part of the month and were exceedingly brilliant, the weather being entirely clear. A whitish light was also observed to precede the rising moon.

*Hydesville*, Humboldt county, 31st: December was characterized by red skies, which, during the latter part of the month, were observed both before sunrise and after sunset. These conditions were observed on the 1st, 2d, 4th, from 6th to 21st, and 31st. On the last date the display was very beautiful, the entire heavens having been covered with small cumulus and cumulo-stratus clouds, which were of bright orange colors, with a back-ground of deep blue.

*Red Bluff*, 31st: the month has been noted for its numerous brilliant sunsets.

*Los Angeles*: the sunsets of the 11th, 28th, and 29th were remarkably brilliant.

*Cape Mendocino*, 31st: many beautiful sunsets were observed here during the month; that occurring on the 18th being the most brilliant.

*Central America*.—The following extract is taken from a communication of Dr. Earl Flint, of date January 3, 1883, Rivas, Central America:

I see no notice yet about the cause of the blue appearance of the sun—red in early morning. It was noticed in many parts of South America during the last of August and the fore part of September. It was different from that of the red light observed here late in November, attributed by Professor Brooks to meteoric showers.

*Colorado*.—Golden, Jefferson county: a deep crimson light was observed in the western sky in the evening from the 9th to 14th, 16th, 20th, 23d, 24th, 25th, 28th, 29th, 31st. On the last date the glow was very noticeable long after the sun's disappearance. From 5.15 to 5.25 p. m. this coloration extended over fully 80° of the sky, and the new moon, a faint crescent, appeared tinged with green.

*Fort Collins*, Larimer county: brilliant sunrises and sunsets were observed on the 4th, 10th, 25th, and 28th.

*Connecticut*.—Voluntown, New London county: a very brilliant sunset was observed on the 29th.

*Dakota*.—Webster, Day county, 31st: during the last eighteen days of the month the morning twilights were wonderfully bright, lighting the whole landscape with a fiery red color.